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EXAMINER BARTON, JEFFREY THOMAS				
ART UNIT		PAPER NUMBER		
1795				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary

Application No.

10/594,073

Applicant(s)

PHILLIPS ET AL.

Examiner

Jeffrey T. Barton

Art Unit

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 February 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (FTO/SB/CP)
Paper No(s)/Mail Date 20060925, 20070409, 20080220.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 2, 3, 14, 15, 28, and 29 are objected to because of the following informalities:

- a. In claims 2, 3, 14, 15, 28, and 29, it is suggested that the word "are" be replaced with "form" in order to more accurately describe the recited structure. Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 13 and 15-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Robinson. (US 6,174,780)

Regarding claim 13, Robinson discloses an electrical circuit (e.g. Figure 3; Column 7, lines 46-58) comprising an absorber of incident electromagnetic radiation (Polysilicon layer 34); a trimetasphere-containing material in electron-transferring contact with the absorber (High dielectric film 31; Column 7, lines 6-18 and 48-51; Column 3, lines 42-55; Column 4, lines 29-47); an anode (e.g. n-type region 32); a cathode (e.g. polysilicon region 34); and a current path from anode to cathode (Between layers 34 and 32, through layer 31; although the circuit is a capacitor, a finite leakage

current will inherently be present upon voltage application to the electrodes). Robinson discusses metal oxide dielectrics encapsulated in fullerenes in the citations given above, which reads on "trimetasphere" as broadly described in the specification at Page 4, lines 5-7.

Regarding claim 15, the absorber and trimetasphere layers will not be perfectly even, leading inevitably to a transition region of mixed absorber/trimetasphere composition. This structure reads on "blended".

Regarding claim 16, Robinson discloses the anode (e.g. region 32) being in contact with the trimetasphere layer (31). (Figure 3)

Regarding claim 17, Robinson discloses the cathode (e.g. polysilicon 34) being the absorber, which would inherently meet the electrical contact requirement. (i.e. the material is in electrical contact with itself)

Regarding claim 18, Robinson discloses the trimetasphere being a carbon-cage structure with an interior volume, encapsulating one or more metal atoms complexed with a non-carbon heteroatom. (Column 7, lines 6-18 and 48-51; Column 3, lines 42-55; Column 4, lines 29-47) Encapsulated metal oxides meet the limitations.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al (US 2002/0189666) in view of Trulove. (NPL Citation in IDS of 25 September 2006)

Regarding claim 1, Forrest et al disclose a photovoltaic device for conversion of incident electromagnetic radiation to electricity, comprising: an absorber of incident electromagnetic radiation (Copper phthalocyanine (CuPc); Figure 1 shows a bandgap of 1.7 eV, which corresponds to absorption onset at 730 nm; Paragraph 0030); a fullerene electron transfer layer in electron transferring contact with the absorber (Paragraphs

0027-0030); an anode in contact with the fullerene layer (Paragraphs 0032 and 0033; Paragraph 0056 describes the laminate in its first sentence, which includes an Al electrode in contact with the fullerene layer); and a cathode in electrical contact with the absorber (Paragraph 0033)

Regarding claim 13, the structure described above as relevant to claim 1 also reads on the same limitations. Additionally, Forrest et al disclose measuring a short-circuit current of one of their cells (Figure 3 inset; Paragraph 0024), such a short circuit (i.e. no load) provides a current path between the electrodes.

Regarding claim 27, Forrest et al disclose a method of converting incident radiation to electricity, comprising: absorbing the radiation to produce an electron-hole pair (Radiation absorption described in paragraphs 0008 and 0043, this is inherent in solar cells); transferring an electron in the LUMO of the absorber across a bandgap to the fullerene-containing layer (Figure 1; process is described in Background section at paragraphs 0008-0013; since the fullerene layer is the "acceptor type" ETL (Paragraphs 0016 and 0028), excited electrons would be transferred from the hole transport layer to the fullerene layer in operation); injecting an electron from the fullerene layer into the anode (Figure 1) and transferring a hole in the HOMO of the CuPc layer into the cathode; and completing a circuit between the anode and cathode. (These final steps are inherent in the operation of this cell - the hole and electron transport are necessary for functioning of the cell, and completing the circuit is the only way to extract power from the cell, which is shown in Figures 2-4)

Regarding claims 2, 14, and 28, Forrest discloses the boundary between the

fullerene layer and absorber (CuPc) being a heterojunction. (Paragraph 0030)

Regarding claims 3, 15, and 29, the absorber and fullerene layers will not be perfectly even, leading inevitably to a transition region of mixed absorber/fullerene composition. This structure reads on "blended".

Regarding claims 16 and 17, these limitations were addressed in addressing claim 1 above.

Regarding claim 37, the bandgap of CuPc is 1.7 eV, which corresponds to an absorption onset of 730 nm, which falls in the visible spectrum. (red)

In addition, Forrest suggests the use of layers of modified fullerenes, with the only criterion being that they function as efficient electron transfer layers.

Forrest does not explicitly disclose using trimetaspheres in the electron transfer layers.

Trulove discloses applications for trimetaspheres (Pages 5-8), including explicit suggestion that current fullerene-containing organic photovoltaic devices would be improved by using trimetaspheres instead. (Page 6, 2nd column, 4th full paragraph)

Regarding claims 4, 18, and 30, Trulove discloses the trimetasphere including a carbon cage structure with an interior volume, encapsulating metal ions complexed with a non-carbon heteroatom. (Page 2, 2nd column, 1st full paragraph; Page 4, 1st column, 2nd full paragraph - Page 6, 1st column, 1st full paragraph)

Regarding claims 5, 6, 19, 20, 31, and 32, Trulove discloses the trimetasphere

having this general formula ($n=0$), where N is nitrogen. (Page 2, 2nd column, 1st full paragraph; Page 4, 1st column, 2nd full paragraph - Page 6, 1st column, 1st full paragraph)

Regarding claims 7-10, 21-24, and 33-36, Trulove discloses A or X being scandium. (with $n=0$ or $n=3$, accordingly) (Paragraph bridging the 1st columns of pages 4 and 5, last sentence)

Regarding claims 11, 12, 25, 26, 38, and 39, Trulove discloses this structure, which includes a heteroatom (nitrogen). (Page 4, 1st column, 2nd full paragraph - Page 6, 1st column, 1st full paragraph)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the solar cell of Forrest et al by replacing the fullerene molecules with trimetaspheres, as suggested by Trulove, because Trulove suggested that it was believed that this would result in a five-to-tenfold increase in cell efficiency. (Page 6, 2nd column, 4th full paragraph)

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey T. Barton whose telephone number is (571)272-1307. The examiner can normally be reached on M-F 9:00AM - 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on (571) 272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jeffrey T. Barton/
Primary Examiner, Art Unit 1795
13 September 2010